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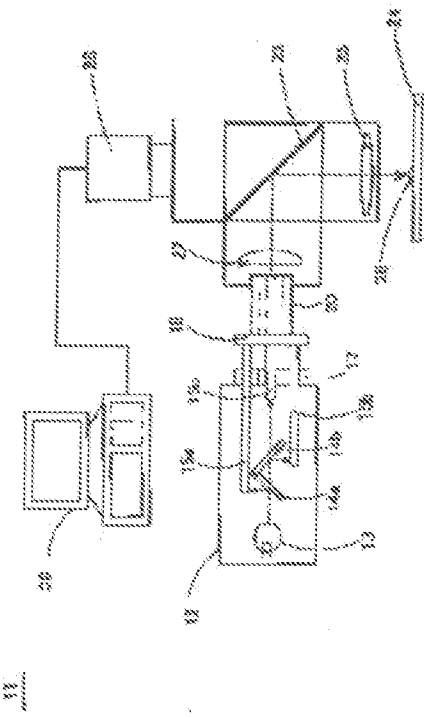
(54) THREE-DIMENSIONAL SHAPE INSPECTION DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a three-dimensional shape inspection device for detecting the three-dimensional shape of an object irradiated with a spectrally separated white light by use of a wavelength selecting mirror, and projecting the lights obtained by spectral separation from irradiating angles differed for every wavelength.
SOLUTION: White light is projected to a dichroic mirror 14a for reflecting only light of blue wavelength band and transmitting lights of wavelength bands other than blue and a dichroic mirror 14b for reflecting only light of green wavelength band and transmitting lights of wavelength bands other than green to spectrally separate it to blue light, green light and red light, which are then guided to optical fiber bundles 15a, 15b and 15c. Sine the arrangements of individual optical fibers constituting the optical fiber bundles 15a, 15b, and 15c are varied in a fiber guide 20, the lights emitted from the fiber guide 20 form concentric lights differed in radius every wavelength band. These lights are projected to an object to be inspected 26 by use of an objective lens 26, and the image obtained by a color CCD camera 28 is processed in a processor 29 to judge the shape of the object to be inspected.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the three-dimensions configuration test equipment which observes the shape of surface type of a three-dimensions configuration object.
[0002]
[Description of the Prior Art] Conventionally, it is used in order to inspect the good and the defect of soldering of the components which the three-dimensions configuration detection equipment which used the active sensing method as equipment which observes the shape of surface type of a spacial configuration object is known, for example, were mounted on the substrate.
[0003] Drawing 1 is the schematic diagram of the three-dimensions configuration test equipment 1 using the active sensing method by the conventional example. This three-dimensions configuration test equipment 1 consists of level examining table 5 for placing three ring-like emitter 2a, 2b, 2c, and color CCD camera 3 and the inspection object 4. Ring-like emitter 2a, 2b, and 2c emit the light (for example, red light, green light, blue glow) of wavelength different, respectively, and are installed in the height of h3, h2, and h1 (however, h3>h2>h1) from the examining table 5 sequentially from what has a big radius. Moreover, the inspection object 4, each ring-like emitter 2a, 2b, 2c, and color CCD camera 3 are arranged on the same medial axis 6, and color CCD camera 3 is installed above all ring-like emitter 2a, 2b, and 2c.
[0004] From ring-like emitter 2a, red light is floodlighted towards all [from ring-like emitter 2b, green light carries out by illuminating-angle 2 j**delta j, and / k / illuminating-angle 2 k**delta / from ring-like emitter 2c / blue glow / centering on a medial axis 6] to the inspection object 4, respectively by illuminating-angle 2 i**delta i. Suppose that an illuminating angle means each ring-like emitter 2a, 2b, the light by which outgoing radiation was carried out from 2c, and the include angle which a medial axis 6 makes here. As shown in drawing 1 , when ring-like emitter 2a, 2b, and the light floodlighted from 2c reflect in respect of having the specific inclination of the front face of the inspection object 4, the reflected light carries out incidence to color CCD camera 3. Therefore, when ring-like emitter 2a, 2b, and the inspection object 4 that received the exposure of light from 2c are seen from color CCD camera 3, the field which has a specific inclination according to each illuminating angle will be colored, and it will be visible.
[0005] Here, it colors and explains using drawing 2 whether the field which is in sight is a field like an inspection object surface throat. The light floodlighted towards the inspection object 4 from one cross section of ring-like emitter 2a shown in drawing 1 reflects in respect of [8] the front face of the inspection object 4, and drawing 2 shows signs that incidence is carried out to color CCD camera 3. However, in drawing 2 , in order to make a reflective situation easy to understand, the inspection object 4 of drawing 1 is drawn more greatly than ring-like emitter 2a and color CCD camera 3.
When red light is turned to the inspection object 4 and floodlighted by illuminating-angle 2 i**delta i from one cross section of ring-like emitter 2a, the reflected light of the width of face corresponding to this width of face is reflected on inspection object 4 front face. At this time, the light reflected in respect of [9] having the inclination to which the line which divides an illuminating angle into two equally turns into a normal 10 from the law of reflection of light that the incident angle i of light and angle-of-reflection i' become equal carries out incidence to color CCD camera 3, as shown in drawing 2 . Therefore, when the inspection object 4 is seen from color CCD camera 3, it is colored

red and only a field with the same inclination as a field 9 is in sight. Moreover, if it has another way of speaking, the inclination from the level datum level 7 can say that it is colored red and the field (henceforth the field of the tilt angle i) of i is in sight.

[0006] When it will be colored green, and the field of the tilt angle j will be in sight, and blue glow will be floodlighted by ring-like emitter 2c to illuminating-angle 2k, if similarly green light is floodlighted by ring-like emitter 2b to illuminating-angle 2j and the inspection object 4 is seen from color CCD camera 3, and the inspection object 4 is seen from color CCD camera 3, it is colored blue and the field of the tilt angle k is in sight.

[0007] Thus, when whenever [illuminating-angle] is changed and the light of different wavelength is floodlighted to the inspection object 4, since it colors and the inspection object 4 seen from color CCD camera 3 appears with different color according to a surface configuration, if the coloring pattern of these images is analyzed, the concave convex voice of an inspection object front face can be judged.

[0008]

[Problem(s) to be Solved by the Invention] When using the above three-dimensions shape-recognition equipments, the objective solid configuration could be judged, but since the light source according to individual was used for every ring-like emitter in conventional three-dimensions configuration test equipment, equipment was enlarged and consumption energy was abundant. each emitter of every [moreover,] -- many years past ---like -- it is -- carrying out -- if degradation with time took place and dispersion in brightness arose, since it would color even if it is the same tilt angle and condition would change, periodical adjustment had to be carried out for every light source. Moreover, when the wavelength of the light which emits light from each ring-like emitter overlapped, the image of the clear color which was effective was not obtained, but there was also a problem that shape-recognition precision fell.

[0009]

[Description of the Invention] It is in offering the three-dimensions configuration test equipment which this invention is made in view of the above-mentioned trouble, and the place made into the purpose floodlights on a body the light which carried out the spectrum, carried out the spectrum of the white light and acquired it using the wavelength selection mirror from whenever [different illuminating-angle / for every wavelength], and detects an objective solid configuration.

[0010] In the three-dimensions configuration test equipment which the three-dimensions configuration test equipment concerning this invention changes whenever [illuminating-angle], irradiates at an object the light from which wavelength differs, and detects the three-dimensions configuration of an object the source of the white light, and the spectrum which carries out the spectrum of the white light using a wavelength selection mirror -- with a means It is characterized by having the optical transducer which changes into concentric circular the flux of light cross section of the light of each wavelength region by which the spectrum was carried out, the optical exposure section which irradiates the outgoing radiation light from said optical transducer by different illuminating angle for every wavelength region at an object, and the image sensor which recognizes the reflected light from an object for every wavelength.

[0011] the light by which outgoing radiation was carried out from the source of the white light if it was in this three-dimensions configuration test equipment -- a spectrum -- a spectrum is carried out to the light of two or more wavelength regions by penetrating or reflecting by the wavelength selection mirror of a means, and after being changed into the light which has a flux of light cross section concentric circular by the optical transducer, it irradiates by illuminating angle which is different for every wavelength region towards an object from the optical exposure section. Consequently, the light which is reflected on an object front face and goes into an image sensor will turn into light of a different wavelength region, if the inclinations on the front face of an object differ. Therefore, the shape of surface type of an object can be judged from disassembling the image of the object currently illuminated by the optical exposure section for every wavelength region, or its coloring condition.

[0012] Since the source of the white light does not need two or more light sources that there should just be even the minimum in the light source in order to carry out the spectrum of the white light to two or more light from which wavelength differs using a wavelength selection mirror, if it is in the

three-dimensions configuration test equipment of this invention, three-dimensions configuration test equipment can be miniaturized. Moreover, each light obtained by carrying out the spectrum of the white light does not have the lap of a wavelength field, since whenever [monochrome] is high, the image of clear color is obtained and its shape-recognition precision of an inspection object improves.

[0013] the spectrum which carries out the spectrum of said white light -- what is necessary is to reflect only the light of for example, specific wavelength in a means, and just to use for it the wavelength selection mirror which penetrates the light of other wavelength, and the wavelength selection mirror which penetrates only the light of specific wavelength and reflects the light of other wavelength A dichroic mirror is mentioned as a suitable example of a wavelength selection mirror. Since the lap of the wavelength region of the light by which the spectrum was carried out can be made small as compared with a color filter etc. according to the dichroic mirror, the inspection precision of three-dimensions configuration test equipment can be raised.
[0014] What carried out the rearrangement of the optical outgoing radiation edge of the optical fiber of for example, the same wavelength region to concentric circular may be used for said optical transducer. May make it unite with a means and only the light of a specific wavelength region is penetrated. moreover, said optical transducer -- said spectrum -- Arrange the disc-like or annular wavelength selection mirror which reflects the light of other wavelength regions to concentric circular [from which a radius differs for every wavelength region to penetrate], and the white light is irradiated at the wavelength selection mirror concerned. The reflected light may be made to carry out outgoing radiation of the concentric circular light from which a radius differs for every wavelength band by making the part where it is made to reflect by the mirror again in, and the wavelength selection mirrors concerned differ carry out incidence.
[0015] Moreover, the ******** optical system for making outgoing radiation light turn and ******** to an object may be used for said optical exposure section. Here, ******** optical system means optical system the optical axis of the illumination light irradiated by the object and whose optical axis of the light which reflects with an object and carries out incidence to an image sensor correspond. For example, if a concentric circular light from which a radius differs for every wavelength band by which outgoing radiation was carried out from said optical transducer is irradiated using the objective lens of a microscope, the case where an object is very small, and the interior of a concave surface can also be inspected.
[0016] A color CCD camera may be used for the image sensor which photos the object which has irradiated light. Moreover, the light which carried out incidence to the image sensor may be distributed to monochrome CCD which is different for every wavelength band using a wavelength selection mirror.
[0017] In the three-dimensions configuration test equipment by another operation gestalt of this invention, it is characterized by adjusting the luminous energy by which the spectrum was carried out using a polarization means. Since according to this operation gestalt only the light which has a specific wavelength band from a specific include angle is irradiated at an inspection object and only the specific field of an inspection object can also be observed, the alternative of the inspection approach can increase and inspection according to the condition of an inspection object etc. can be conducted.
[0018] In addition, the component explained the above of this invention is combinable with arbitration as much as possible.
[0019]
[Embodiment of the Invention] (1st operation gestalt) Drawing 3 is the sectional view showing the structure of floodlighting section 12 near [the three-dimensions configuration test equipment 11 which is 1 operation gestalt of this invention]. The floodlighting section 12 consists of the sources 13 of the white light, such as a halogen lamp, dichroic mirrors 14a and 14b of two sheets, three bundles of optical-fiber bundles 15a, 15b, and 15c, and the exit 17 of Idemitsu. First dichroic mirror 14a reflects only blue glow, the light of the other wavelength is a mirror to penetrate, second dichroic mirror 14b reflects only green light, and the other light is a mirror to penetrate. If the white light is floodlighted towards first dichroic mirror 14a from the source 13 of the white light, a spectrum will be carried out to light other than blue glow 16a and blue by first dichroic mirror 14a.

The spectrum of the light which penetrated first dichroic mirror 14a is carried out to green light 16b and red light 16c by second dichroic mirror 14b.

[0020] Incidence of blue glow 16a by which the spectrum was carried out, green light 16b, and the red light 16c is carried out to the end of the optical-fiber bundles 15a, 15b, and 15c which bundled two or more fibers, respectively. In order to combine efficiently with each optical-fiber bundles 15a, 15b, and 15c blue glow 16a by which the spectrum was carried out, green light 16b, and red light 16c at this time, you may make it make each optical-fiber bundles 15a, 15b, and 15c condense the light of each color through a lens system. Moreover, it is desirable to make it the light irradiated by each optical-fiber bundles 15a, 15b, and 15c irradiate equally each optical fiber which constitutes each optical-fiber bundles 15a, 15b, and 15c. Three bundles of optical-fiber bundles 15a, 15b, and 15c are brought together in the fiber union section 18 in the exterior of the floodlighting section 12 from the exit 17 of Idemitsu. In the fiber union section 18, it is taken into pieces by the optical fiber 19 per, and inside the fiber guide 20 of a cylindrical shape, each optical-fiber bundles 15a, 15b, and 15c rearrange, and a rearrangement is carried out. As shown in drawing 4 , the rearrangement of each optical fiber 19 is carried out so that it may be set to optical fiber bundle 15b for optical-fiber bundle 15c for a core to carry out the light guide of the red light and its periphery section to carry out the light guide of the green light, and optical fiber bundle 15a for the periphery section to carry out the light guide of the blue glow further. Moreover, inside the fiber guide 20, in order to make it the light of the wavelength band where the adjacent optical-fiber bundles 15a, 15b, and 15c differ not mixed, the partition 21 of aluminum foil etc. is formed among the optical-fiber bundles 15a, 15b, and 15c which carry out the light guide of the light from which wavelength differs.

[0021] Drawing 5 is the sectional view showing the structure of the three-dimensions configuration test equipment 11 containing the floodlighting section 12 shown in drawing 3 . The optical exposure section of this three-dimensions configuration test equipment 11 serves as the same optical system (********* optical system) as a microscope. After concentric circular light by which outgoing radiation was carried out from the end of the fiber guide 20 is made into parallel light with a collimate lens 22, the direction of radiation is changed in the direction of the examining table 24 by the half mirror 23, and it is *********(ed) by the objective lens 25 towards the inspection object 26.

[0022] Since the light which carried out incidence to the objective lens 25 changes an outgoing radiation include angle by whether it is the light which carried out incidence to which radial location from the medial axis 27 of an objective lens 25 as shown in drawing 6 , If the core of a concentric circular light which carries out incidence to the medial axis 27 of a lens is made in agreement, red light 16c of the circle configuration by which outgoing radiation was carried out from optical-fiber bundle 15c by whenever [small illuminating-angle] Blue glow 16a of the shape of a circular ring to which outgoing radiation of the green light 16b of the shape of a circular ring by which outgoing radiation was carried out from optical-fiber bundle 15b was carried out from optical-fiber bundle 15a by whenever [bigger illuminating-angle / than red light] will irradiate the inspection object 26 by whenever [still bigger illuminating-angle / than green light 16b].

[0023] Drawing 7 shows signs that it irradiates with the light by which the inspection object 26 was *********(ed) from the objective lens 25. As shown in drawing 7 R> 7, in order to irradiate light from an include angle which is different to the same field of the front face of the inspection object 26, it is good to use the aberration of an objective lens 25. Since a focal distance becomes short, and a refractive index changes with wavelength according to the spherical aberration of a lens according to the chromatic aberration of a lens as it tends toward radial from the medial axis of a lens, when the light from which wavelength differs in the same location of an objective lens carries out incidence, a focal distance changes with wavelength. Therefore, if it arranges from a medial axis to radial and the property of the above lenses is used sequentially from light with long wavelength like this operation gestalt in case the light which carried out the spectrum is rearranged into concentric circular for example, the light of wavelength which is different to the same field of an inspection object can be irradiated.

[0024] When the inspection object 26 with which light was irradiated is seen from color CCD camera 28 installed right above the inspection object 26, it is colored red and the field which makes a normal the line which divides the illuminating angle of red light 16c into two equally is in sight, it is colored ********* green and blue and the field which makes a normal similarly the line which

divides the illuminating angle of green light 16b and blue glow 16a into two equally is in sight.
[0025] Color CCD camera 28 is connected with the processor 29 which consists of a personal computer and predetermined software, can display the image photoed with color CCD camera 28 on a display, and can inspect the concave convex voice of the front face of the inspection object 4. Moreover, if the image information of a good soldering side and the image information of the case of poor solder are beforehand memorized to the processor 29 and the image of the inspection object 26 is compared with these images when conducting inspection of a soldering side etc., for example, automatic sorting of the good and the defect of solder can be carried out according to coloring condition.
[0026] According to this operation gestalt, since there should just be at least one source of the white light, using two or more light sources, there can be little power consumption, can end and can also miniaturize [rather than] equipment. Moreover, since there should just be at least one source of the white light, it is not necessary to perform adjustment of the quantity of light or physical relationship for every light source like [in the case of using two or more light sources].
[0027] Moreover, since light without the lap of a wavelength field with whenever [monochrome / high] be obtain like this operation gestalt according to the approach of carry out the spectrum of the one white light using a dichroic mirror, the image on the front face of a body colored by the exposure of light turn into a clear image whose contrast be effective, and tend to recognize a concavo-convex condition, and its inspection precision improve.
[0028] Moreover, although the optical outgoing radiation edge of an optical fiber is arranged so that outgoing radiation of the light may be carried out to concentric circular if it is in this operation gestalt, you may make it the configuration of arbitration other than a concentric circle. Moreover, it can be used for configuration inspection of the inspection object of various magnitude by making the number of an optical fiber fluctuate. Furthermore, if an inspection object is irradiated using ******** optical system, since the light by which outgoing radiation was carried out to concentric circular like this operation gestalt can be irradiated by the small illuminating angle, light can be irradiated even inside concave, and even if it is the inspection object of the complicated configuration, it can inspect.
[0029] (2nd operation gestalt) Drawing 8 shows the floodlighting section 12 of the three-dimensions configuration test equipment which is another operation gestalt of this invention. This floodlighting section 12 consists of dichroic mirrors 14a and 14b of one source 13 of the white light, and 30 or 2 collimate lenses, and total reflection mirrors 31a and 31b of two sheets. Light by which outgoing radiation was carried out from the source 13 of the white light is made into parallel light with a collimate lens 30, and carries out incidence to first dichroic mirror 14a. In first dichroic mirror 14a, only blue glow 16a is reflected and the light of other wavelength fields penetrates. Incidence of the light which penetrated first dichroic mirror 14a is carried out to second dichroic mirror 14b, and a spectrum is carried out to green light 16b reflected by second dichroic mirror 14b, and red light 16c which penetrates second dichroic mirror 14b. A travelling direction is changed so that it may become parallel to red light 16c, and the light guide of blue glow 16a and green light 16b which were reflected with the first and the second dichroic mirror 14a and 14b is carried out to the exit 17 of Idemitsu by total reflection mirrors 31a and 31b, respectively. Outgoing radiation of the light by which outgoing radiation is carried out from this floodlighting section 12 is carried out as a concentric circular light from which a radius differs for every wavelength band from the optical outgoing radiation edge of each optical-fiber bundles 15a, 15b, and 15c in which the light guide was carried out to the fiber union section 18 by the optical-fiber bundles 15a, 15b, and 15c and by which the rearrangement was carried out to concentric circular within the fiber guide 20 like the floodlighting section 12 shown in drawing 3 .
[0030] (3rd operation gestalt) Drawing 9 shows the floodlighting section 12 of the three-dimensions configuration test equipment which is still more nearly another operation gestalt of this invention. This floodlighting section 12 consists of dichroic mirrors 14c and 14d of one source 13 of the white light, and 30 or 2 collimate lenses, and a total reflection mirror 31. Light which carried out outgoing radiation from the source 13 of the white light is made into parallel light with a collimate lens 30, and carries out incidence to first dichroic mirror 14c. In first dichroic mirror 14c, only blue glow 16a is penetrated and the light of other wavelength fields is reflected. Incidence of the light which

reflected first dichroic mirror 14c is carried out to second dichroic mirror 14d. Second dichroic mirror 14d, only red light is made to penetrate, the light of other wavelength fields is reflected, and a spectrum is carried out to red light 16c which penetrates second dichroic mirror 14d, and green light 16b which reflects second dichroic mirror 14d by second dichroic mirror 14d. A travelling direction is changed so that red light 16c may become parallel to blue glow 16a which penetrated first dichroic mirror 14c, and green light 16b reflected by second dichroic mirror 14d by the total reflection mirror 31, and the light guide of the light of three colors is carried out to the exit 17 of Idemitsu, respectively. Outgoing radiation of the light by which outgoing radiation is carried out from this floodlighting section 12 is carried out as a concentric circular light from which a radius differs for every wavelength band from the optical outgoing radiation edge of each optical-fiber bundles 15a, 15b, and 15c in which the light guide was carried out to the fiber union section 18 by the optical-fiber bundles 15a, 15b, and 15c and by which the rearrangement was carried out to concentric circular within the fiber guide 20 like the floodlighting section 12 shown in drawing 3 .

[0031] (4th operation gestalt) Drawing 10 shows the floodlighting section 12 of the three-dimensions configuration test equipment which is still more nearly another operation gestalt of this invention. This floodlighting section 12 consists of one source 13 of the white light, four polarizing plates 32a, 32b, 32c, and 32d, dichroic mirrors 14a and 14b of two sheets, and total reflection mirrors 31a and 31b of two sheets. The light by which outgoing radiation was carried out from the source 13 of the white light is changed into the linearly polarized light by the 32d of the first polarizing plate, and is irradiated by first dichroic mirror 14a. In first dichroic mirror 14a, only blue glow 16a reflects and the light of other wavelength penetrates. Incidence of the light which penetrated first dichroic mirror 14a is carried out to second dichroic mirror 14b, and a spectrum is carried out to red light 16c which penetrates green light 16b reflected by second dichroic mirror 14b, and second dichroic mirror 14b. A travelling direction is changed so that blue glow 16a and green light 16b which were reflected with the first and the second dichroic mirror 14a and 14b may become parallel to red light 16c by total reflection mirrors 31a and 31b, respectively, and the light guide of blue glow 16a, green light 16b, and the red light 16c is carried out to the second polarizing plate 32a, 32b, and 32c of working, respectively. Outgoing radiation of the light by which outgoing radiation is carried out from this floodlighting section 12 is carried out as a concentric circular light from which a radius differs for every wavelength band from the optical outgoing radiation edge of each optical-fiber bundles 15a, 15b, and 15c in which the light guide was carried out to the fiber union section 18 by the optical-fiber bundles 15a, 15b, and 15c and by which the rearrangement was carried out to concentric circular within the fiber guide 20 like the floodlighting section 12 shown in drawing 3 .

[0032] The second polarizing plate 32a, 32b, and 32c is working, and the transmitted light reinforcement of blue glow 16a which penetrates the second polarizing plate 32a, 32b, and 32c, green light 16b, and red light 16c changes continuously by rotating these. For example, when the plane of polarization of the 32d of the first polarizing plate and the plane of polarization of second polarizing plate 32a become perpendicular as are shown in drawing 11 (a), and the transmitted light reinforcement from second polarizing plate 32a serves as max and it is shown in drawing 11 (b), when the plane of polarization of the 32d of the first polarizing plate and the plane of polarization of second polarizing plate 32a are in agreement, light is not penetrated from second polarizing plate 32a.

[0033] Since according to this operation gestalt inspecting using all the light by which the spectrum was carried out can also take out only the light of a certain specific wavelength and it can also use it for inspection, according to a class, a configuration, etc. of an inspection object, it can inspect with various inspection gestalten.

[0034] (5th operation gestalt) Drawing 12 (a) and (b) are the side elevations and front views of the floodlighting section 12 of three-dimensions configuration test equipment which are still more nearly another operation gestalt of this invention. This floodlighting section 12 consists of reflectors 38 from which one source 13 of the white light, optical-fiber bundle 33, the red light transmission dichroic mirror 34 of a disk mold, the green light transparency dichroic mirror 35 of a ring type, the blue glow transparency dichroic mirror 36 of a ring type, and the wall are a total reflection mirror 37. The optical outgoing radiation side of a reflector 38 is covered with the red light transmission dichroic mirror 34 arranged concentric circular, the green transparency dichroic mirror 35, and the

blue glow transparency dichroic mirror 36.

[0035] If the white light is irradiated at the incidence edge of the optical-fiber bundle 33 from the source 13 of the white light, outgoing radiation of the white light will be carried out to the interior of a reflector 38 from the outgoing radiation edge 39 of the optical-fiber bundle 33 with which the tooth-back section of a reflector 38 was equipped. Although the light of a red wavelength band is penetrated when the white light by which outgoing radiation was carried out from the optical outgoing radiation edge 39 of the optical-fiber bundle 33 carries out incidence to the red transparency dichroic mirror 34 for example, since each dichroic mirrors 34, 35, and 36 penetrate only the light of a specific color and the light of other wavelength makes them reflect it, the light of other wavelength is reflected. It is reflected once [further] or more by the total reflection mirror 37, and incidence of the reflected light is again carried out to one of the dichroic mirrors 34, 35, and 36. When this dichroic mirror is the green transparency dichroic mirror 35, green light will be penetrated and blue glow will be reflected. It is reflected once or more by the total reflection mirror 37, and incidence of the reflected blue glow is again carried out to one of the dichroic mirrors 34, 35, and 36, and, finally it penetrates the blue glow transparency dichroic mirror 36.

[0036] Thus, since the white light which carried out incidence to the reflector 38 will repeat reflection and will penetrate the target dichroic mirror unless it is absorbed by dichroic mirrors 34, 35, and 36 or the total reflection mirror 37, it can carry out the spectrum of the white light easily. Moreover, if the floodlighting section 12 of this operation gestalt is used, it is not necessary to adjust the physical relationship of each dichroic mirrors 34, 35, and 36 or a total reflection mirror 37 after formation of the floodlighting section 12. In addition, if the case where a dichroic mirror is used like this operation gestalt is compared with the case where the wavelength filter which penetrates only the light of a specific wavelength band is used, the wavelength band in which each light has the light obtained with a wavelength filter to a high light of whenever [monochrome] being obtained when a dichroic mirror is used will become large. It follows, for example, since, as for the spectrum of the red light obtained with a wavelength filter, the end laps with the spectrum of green light even if it is the same red light, the resolution like a dichroic mirror is not obtained.

[0037] (6th operation gestalt) Drawing 13 shows the structure of the three-dimensions configuration test equipment 11 by still more nearly another operation gestalt of this invention. Since the source 13 of the white light is established in the reflector 38 interior, the floodlighting section 12 of this operation gestalt does not have to carry out the light guide of the white light with an optical fiber from the source of the white light established in the exterior of a reflector 38, and can miniaturize the floodlighting section. The optical outgoing radiation side of a reflector 38 penetrates only red light, and the light of other wavelength bands is constituted by the circular red light transmission dichroic mirror 34 to reflect, the green light transparency dichroic mirror 35 of the ring type which makes the periphery circle a circumferential circle, and the blue glow transparency dichroic mirror 36 of the ring type which makes the periphery circle a circumferential circle further. If the dichroic mirrors 34, 35, and 36 of this configuration are used, since the light by which the spectrum was carried out to a spectrum and coincidence will be arranged by concentric circular and outgoing radiation will be carried out from the floodlighting section 12, the space for rearranging into concentric circular the light which carried out the spectrum using an optical fiber does not have the need, and can miniaturize three-dimensions configuration test equipment 11.

[0038] (7th operation gestalt) Drawing 14 shows the structure of the image pick-up section 40 of the three-dimensions configuration test equipment which is still more nearly another operation gestalt of this invention. This image pick-up section consists of blue glow reflective dichroic mirror 41a, green light reflective dichroic mirror 41b, and three monochrome CCD cameras 42a, 42b, and 42c. Since each dichroic mirrors 41a and 41b reflect only the light of specific wavelength and the light of the other wavelength penetrates them, when green light 16b carries out incidence to the image pick-up section 40, blue glow reflective dichroic mirror 41a is penetrated, it reflects by green light reflective dichroic mirror 41b, and they carry out incidence of the green light to monochrome CCD camera 42b, for example.

[0039] Drawing 15 shows the three-dimensions configuration test equipment 11 which transposed color CCD camera 28 of the three-dimensions configuration test equipment of drawing 5 to the image pick-up section 40 of this operation gestalt. Incidence of the light reflected with the inspection

object 26 is carried out to monochrome CCD cameras 42a, 42b, and 42c which are different for every wavelength in the image pick-up section 40. Therefore, the image which the image obtained by monochrome CCD camera 42a turns into an image in which only the field which is colored by blue glow 16a and is in sight is shown, and is obtained by monochrome CCD camera 42b turns into an image in which only the field which is colored by green light 16b and is in sight is shown. Moreover, the image obtained by monochrome CCD camera 42c turns into an image in which only the field which is colored by red light 16c and is in sight is shown. The image obtained with each monochrome CCD cameras 42a, 42b, and 42c is processed by each monochrome CCD cameras 42a and 42b and every 42c with a processor, and can be displayed on a display as an image according to individual. Moreover, three of two or images of these can be piled up, and it can also display on a display as a color picture.

[0040] If dichroic mirrors 41a, 41b, and 41c are used as a means to disassemble an image into a blue image, green image, and red image in the image pick-up section 40, since the lap of a transmitted light field can be made small compared with a color filter, the resolution of an image becomes high. And if the dichroic mirrors 41a, 41b, and 41c in the image pick-up section 40 and the dichroic mirror used in the floodlighting section 12 are the things of the same property, the light irradiated from the same direction will enter in same CCD cameras 42a and 42b and 42c, and the error by the side of floodlighting and an image pick-up of it will be lost, consequently its inspection precision will improve.

[0041]

[Effect of the Invention] According to the three-dimensions configuration test equipment of this invention, the spectrum of the white light is carried out using a wavelength selection mirror, since two or more light from which wavelength differs is taken out, that there should just be at least one source of the white light, equipment can be miniaturized and power consumption can be reduced. Moreover, by the homogeneous lights obtained by carrying out the spectrum of the one white light, since a wavelength band does not lap and the image of clear color is obtained, an objective shape-recognition precision improves.

[0042] Moreover, what is necessary is for the adjustment for every light source to become complicated since degradation takes place for each light source of every in accordance with time amount etc. when two or more light sources are used, but according to the three-dimensions configuration test equipment of this invention, just to carry out even adjustment of at least one source of the white light, since there should just be at least one source of the white light.

[0043] If the light which carried out the spectrum of the white light and acquired it is irradiated at the incidence edge of ********** and the outgoing radiation edge of an optical fiber bundle is rearranged, light is rearrangeable in configurations of arbitration, such as concentric circular [from which a radius differs for every wavelength region]. Moreover, since the light by which the spectrum was carried out can be rearranged into concentric circular while carrying out the spectrum of ******* and the white light for the wavelength selection mirror and total reflection mirror which were arranged in concentric circular, three-dimensions configuration test equipment can be miniaturized.

[0044] Moreover, if ******** optical system, such as an objective lens of a microscope, is used, even if it is the case where it has the case where an object is very small, and a concave surface, it can inspect.

[0045] Furthermore, when a polarizing plate is used for the three-dimensions configuration test equipment of this invention, since using all the light by which the spectrum was carried out and by which the adjustment of of the quantity of light was attained for every light, and the spectrum was carried out can also use only the light of specific wavelength, it can inspect with various inspection gestalten.

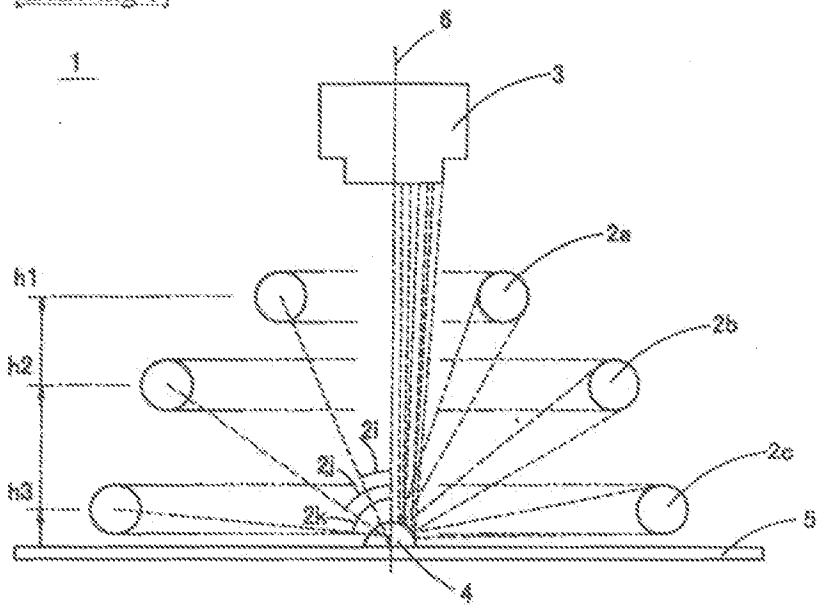
[Translation done.]

* NOTICES *

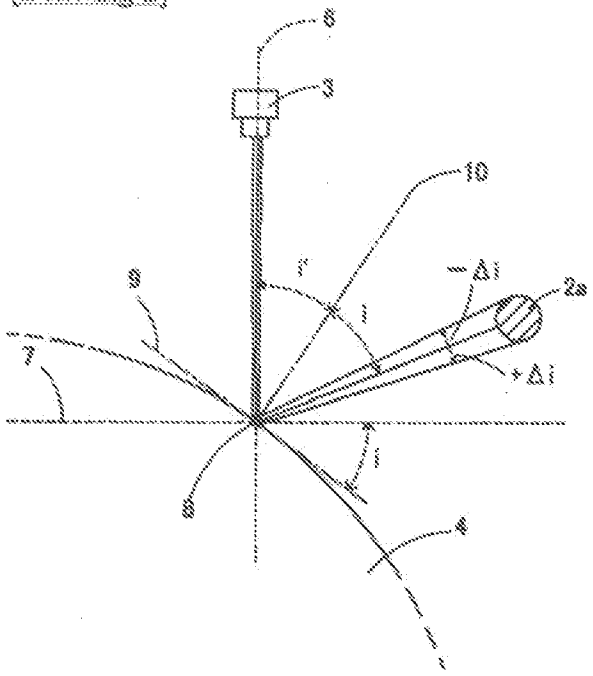
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

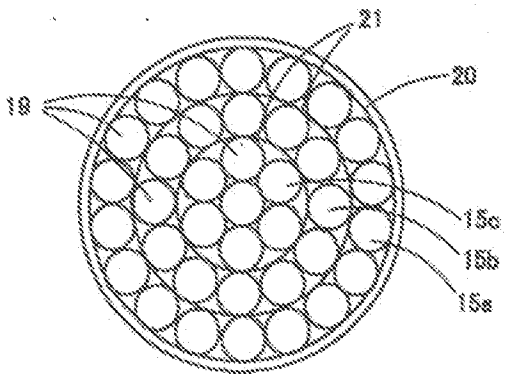
[Drawing 1]



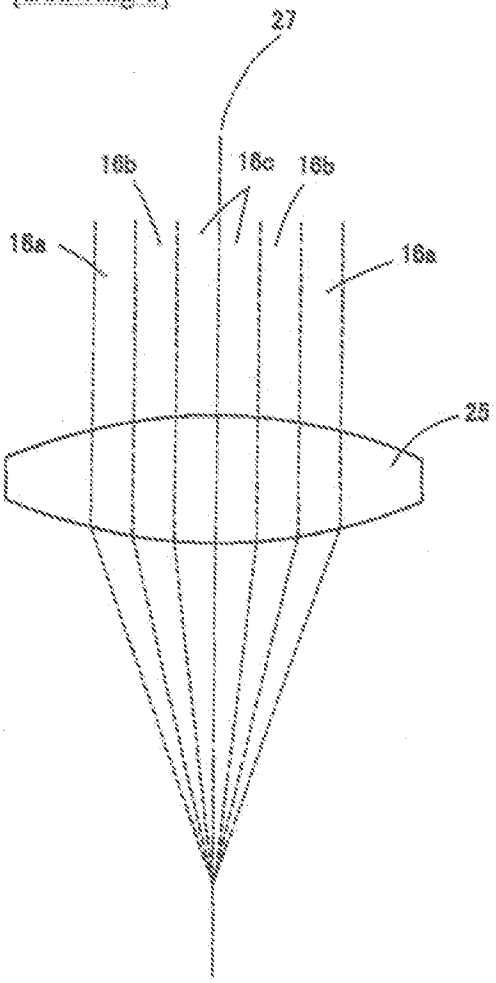
[Drawing 2]



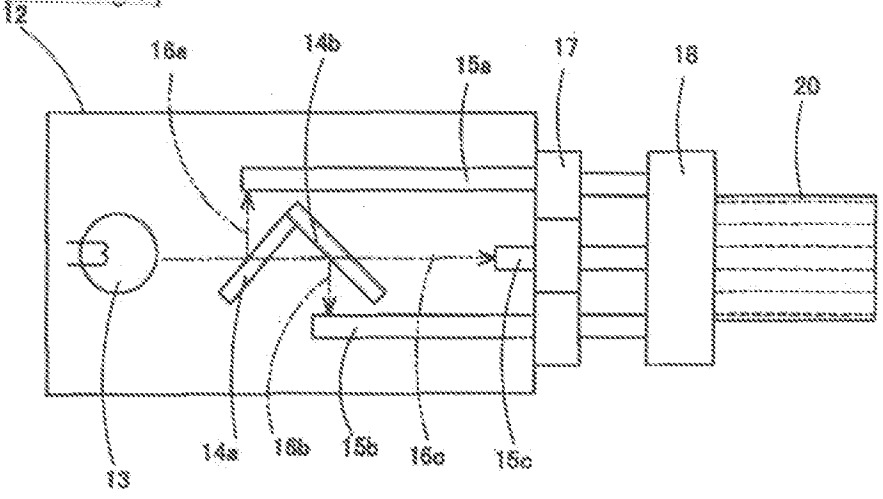
[Drawing 4]



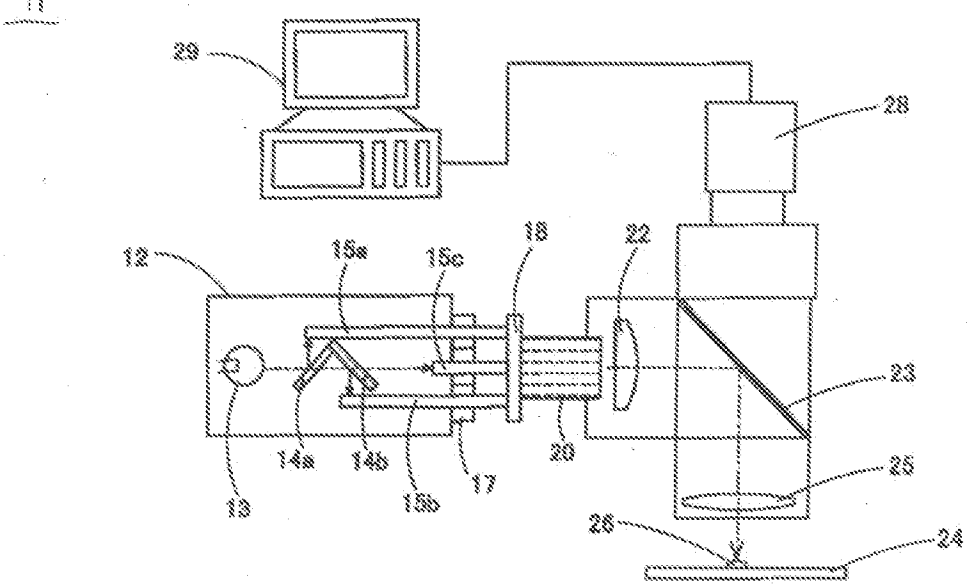
[Drawing 6]



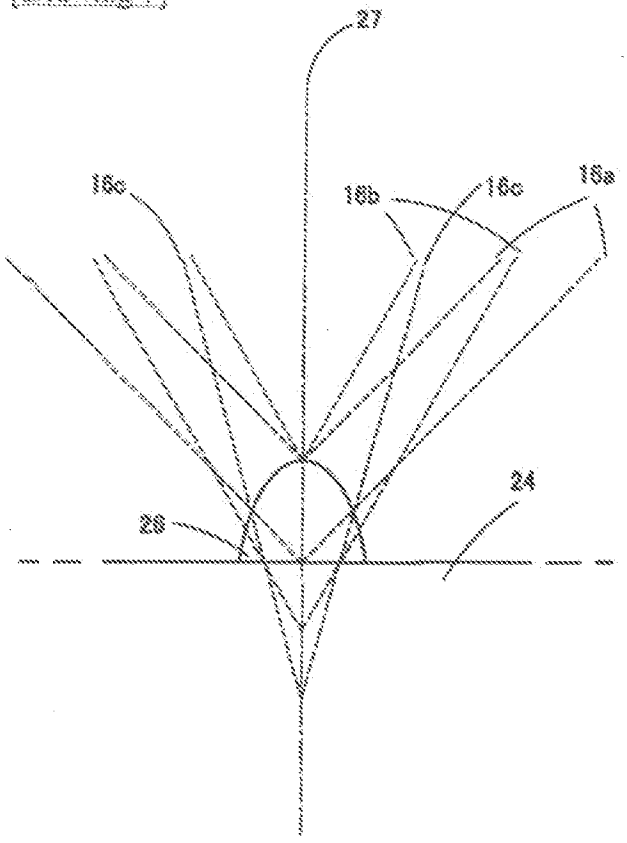
[Drawing 3]



[Drawing 5]

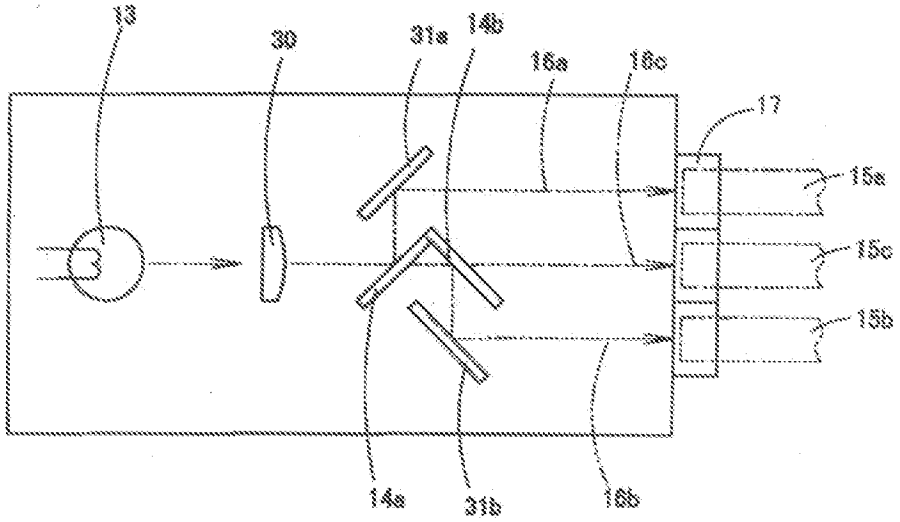


[Drawing 7]

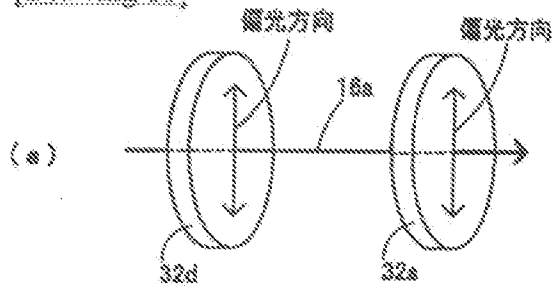


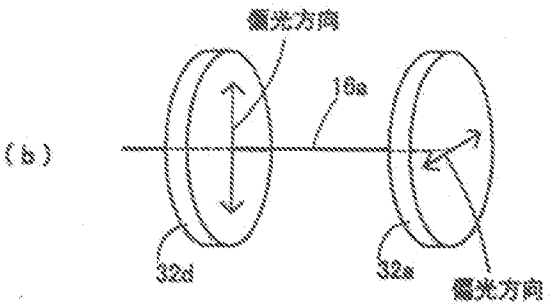
[Drawing 8]

12



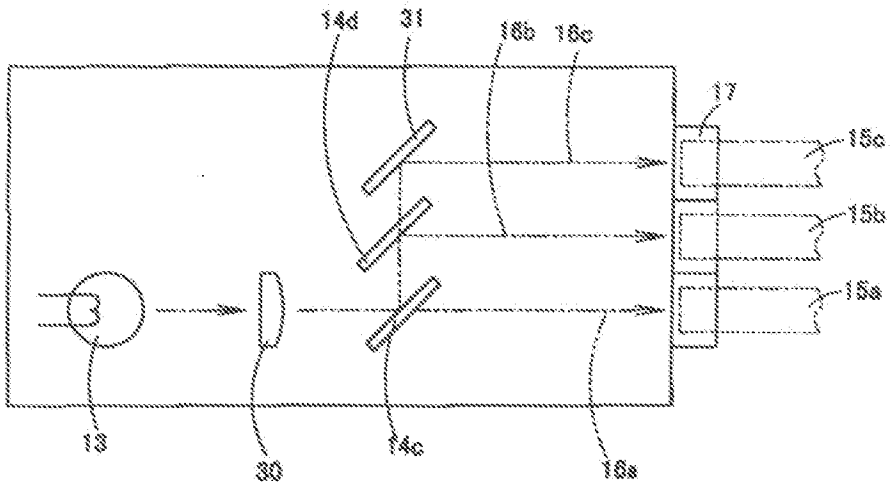
[Drawing 11]



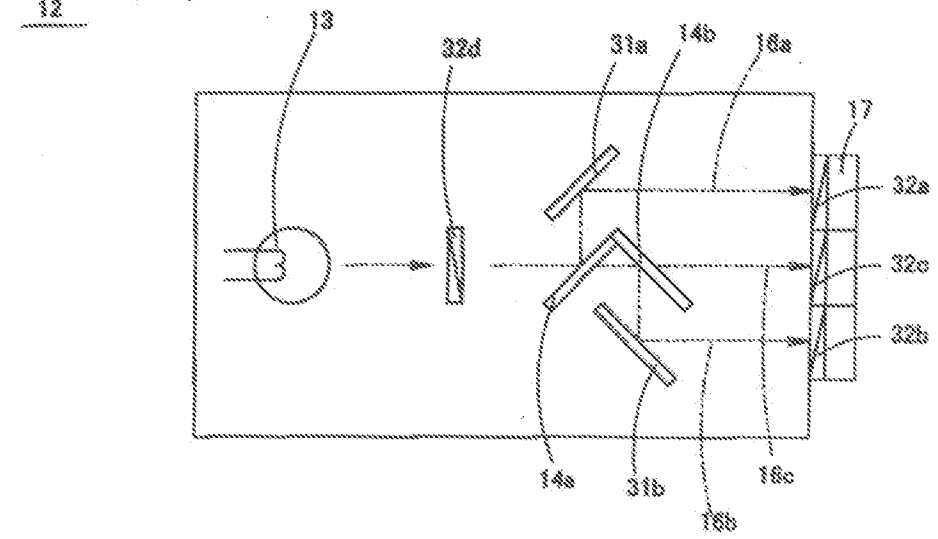


[Drawing 9]

12

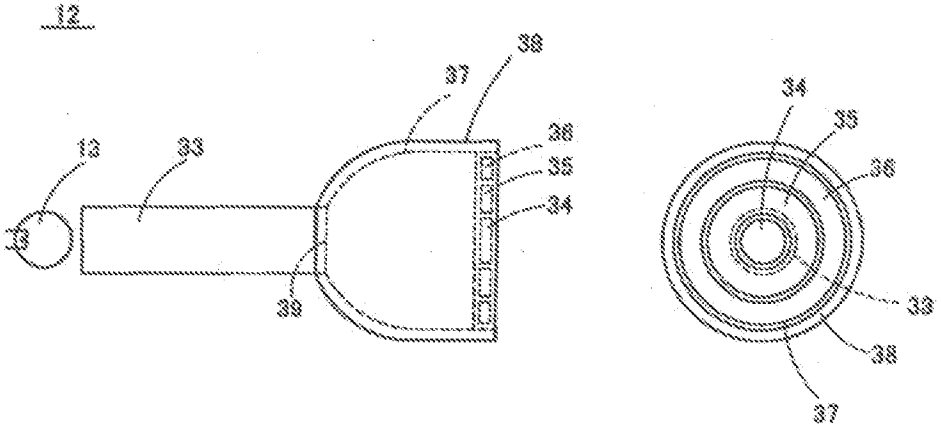


[Drawing 10]

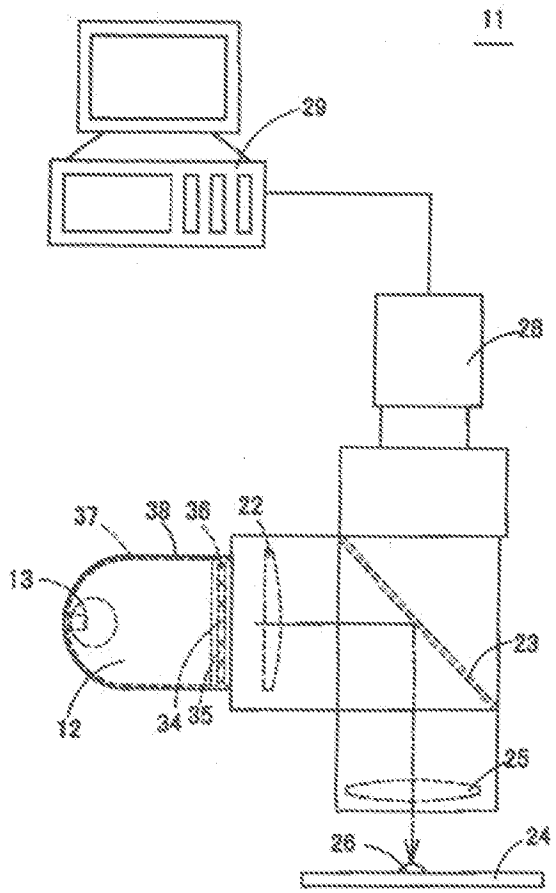


[Drawing 12]

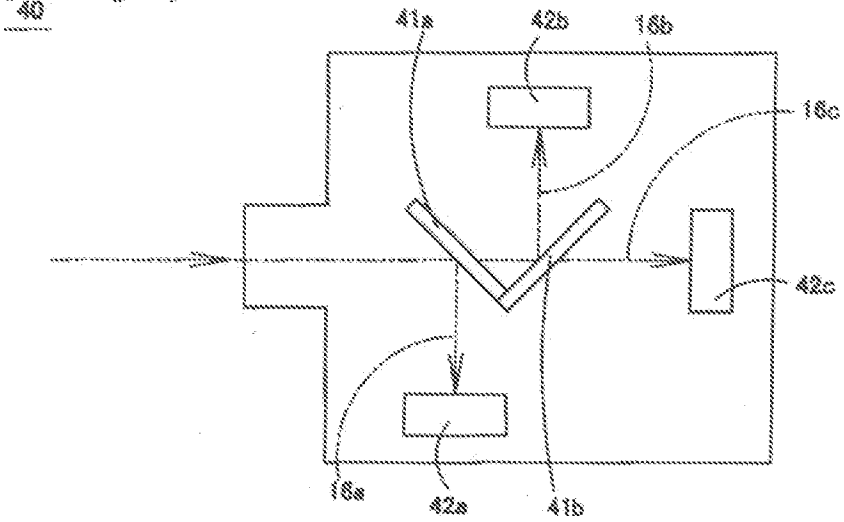
(a) (b)



[Drawing 13]

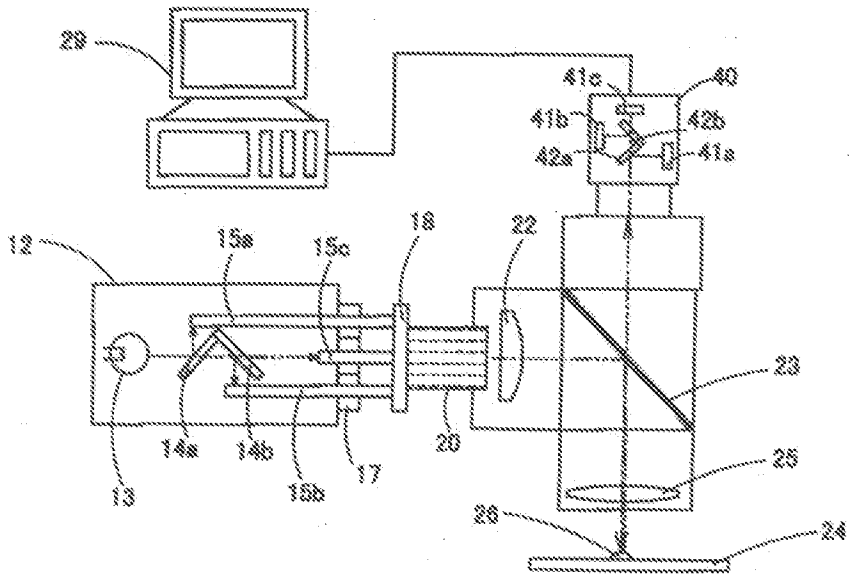


[Drawing 14]



[Drawing 15]

11



[Translation done.]